Diffusion and Thermal Heat Treatment of Bulk Powders

New Process to Heat Treat Bulk Metal Powders Reduces Processing Times and Produces Superior Product

Through a grant from the Department of Energy's Inventions and Innovation Program, Kemp Development Corporation developed a new process that uses a sealed rotary kiln under a vacuum or controlled atmosphere to heat treat bulk metal powders and to treat solid parts with bulk powders. The tumbling action of the rotating cylinder causes the metal particles to flow in a fluidized manner and to experience constant mixing. This action constantly exposes a new layer of metal particles to the hot cylinder surface inside the kiln, increasing heat transfer several fold. In addition, the internal atmosphere prevents the formation of oxides on the surface of the metal particles during heating and cooling periods. Adjusting the rotation rate of the drum produces a several-fold increase in gas-phase reaction kinetics. In addition, controlling drum speed can vary particle-flow behavior over a wide range. Incoming materials can be precipitated out of the gas to provide chemical vapor deposition on the surface of each particle. If needed, residence times can be extended indefinitely to ensure complete diffusion within particles.

Benefits

Environmental Savings
Uses 90% less greenhouse gases, methane, and hydrogen in processing.

Productivity
Reduces processing times to coat and heat-treat materials while producing a superior product. Can create new products that take advantage of more thorough powder processing.

Profitability
By completely eliminating the need to break apart powders, it reduces annealing and associated costs by about 90%.

Reliability
Corrosion- or erosion-control coatings increase end-product lifetimes.

Waste Reduction
Automated loading and unloading of bulk powders reduces or eliminates waste.

Overview

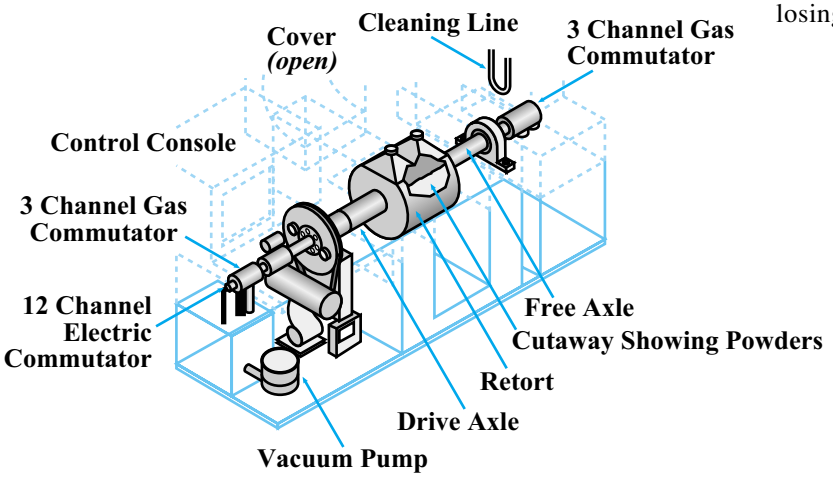
- Commercialized by Kemp Development Corporation in 1998
- Licensed to ACTON Materials, Inc., for treating powders and to PMAC for surface treating solid parts

Applications

- Heat treating powdered metal
- Alloying powdered metals to produce aluminides, carbides, and nitrides and surface treating of solid parts; i.e., boronizing, aluminizing, nitriding, and carburizing
- Processing steel waste streams to improve recycling of ferric chloride
- Refining powder metals; i.e., tungsten or cobalt from ores

Capabilities

- Can process many types of bulk powders, including those destined for frits, glasses, ceramics, refractories, metals, and composites.
- Can heat treat bulk powders to 1050°C.
- Can coat metals on ceramics and ceramics on metals.
- Can produce encapsulated metal powders for thermal storage (with a temperatures range of cryogenic to over 1,000°C), which can be melted without losing powder characteristics.



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Technology No Longer Commercially Available